CLAIMS

What is claimed is:

1. A method for determining the positional BL factor of a transducer during sound transduction comprising the steps of:

(a) changing the current to the transducer;

(b) determining the current through the transducer;

(c) measuring the back EMF of the transducer; and

(d) calculating the positional BL factor from the change in EMF versus change in current.

2. The method of claim 1, further comprising applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is one of a digital and analog.

3. A method for measuring the back EMF of a transducer comprising the steps of:

(a) providing a digitally modulated signal; and

(b) measuring the voltage across the transducer during the off time of the digitally modulated signal.

4. The method of claim 3, further comprising applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.

5. A method for generating sound using a speaker having a transducer, comprising

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1. A method for determining the positional BL factor of a transducer during sound transduction comprising the steps of:

(a) changing the current to the transducer;

(b) determining the current through the transducer;

(c) measuring the back EMF of the transducer; and

(d) calculating the positional BL factor from the change in EMF versus change in current.

2. The method of claim 1, further comprising applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is one of a digital and analog.

3. A method for measuring the back EMF of a transducer comprising the steps of:

(a) providing a digitally modulated signal; and

(b) measuring the voltage across the transducer during the off time of the digitally modulated signal.

4. The method of claim 3, further comprising applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.

5. A method for generating sound using a speaker having a transducer, comprising

the steps of:

(a) determining the positional BL factor during sound transduction through continual measurements; and

(b) digitally modulating a drive signal based on a plurality of transducer models and the positional BL factor during sound transduction of the transducer.

6. The method of claim 5, further comprising applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.

7. A method for generating sound using a speaker having a transducer, comprising the steps of:

(a) generating an electrophysical model of the transducer,

(b) digitally modulating a drive signal based on the continually determined position of the transducer in the electrophysical model,

(c) determining a positional BL factor during sound transduction through continual measurements;

(d) calculating the position of the transducer based upon the BL factor;

(e) updating the position of the transducer in the electrophysical model; and

(f) repeating steps b-e.

8. The method of claim 7, wherein an electrophysical model of the transducer is generated by driving the transducer with a known set of signals, determining the position of the transducer, and measuring one or more of: the back EMF, the power supply voltage, and the transducer current.

9. The method of claim 7 further comprising applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.

10. A method for improving a sound generation device comprising the steps of:

(a) measuring a power supply voltage of the device; and

(b) adjusting a drive signal to the device to compensate for changes in the power supply voltage.

11. The method of claim 10 wherein the drive signal is adjusted by adjusting the shape of the drive signal.

12. The method of claim 11 wherein the pulse shape is adjusted by adjusting the amplitude and/or width of the pulse.

13. The method of claim 10 wherein the drive signal is adjusted by adjusting the amplitude of the drive signal.

14. The method of claim 10 which includes the step of generating a model of the power supply.

15. The method of claim 10 which includes the step of:

(e) modulating the output signal to minimize power supply induced distortion

(PSID), wherein the output signal is provided to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.

16. A method for protecting a speaker having a transducer comprising the steps of:

(a) continually determining a drive power provided to the transducer and

(b) adjusting the drive signal based upon a safe power model of the transducer and the drive power.

17. The method of claim 16 wherein the drive power is integrated over time.

18. The method of claim 16 which includes the step of measuring a power supply voltage to provide an output signal based upon the safe power model.

19. A system for determining the positional BL factor of a transducer during sound transduction comprising:

means for changing the current to the transducer;

means fordetermining the current through the transducer;

means for measuring the back EMF of the transducer; and

means for calculating the positional BL factor from the change in EMF versus change in current.

20. The system of claim 19, further comprising applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is one of a digital and

analog.

21. A system for measuring the back EMF of a transducer comprising:

means for providing a digitally modulated signal; and

means for measuring the voltage across the transducer during the off time of the digitally modulated signal.

22. The system of claim 21, further comprising means for applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.

23. A system for generating sound using a speaker having a transducer, comprising:

means for determining the positional BL factor during sound transduction through continual measurements; and

means for digitally modulating a drive signal based on a plurality of transducer models and the positional BL factor during sound transduction of the transducer.

24. The system of claim 23, further comprising means for applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.

25. A system for generating sound using a speaker having a transducer, comprising:

means for generating an electrophysical model of the transducer,

means for digitally modulating a drive signal based on the continually determined position of the transducer in the electrophysical model,

means for determining a positional BL factor during sound transduction through continual measurements;

means for calculating the position of the transducer based upon the BL factor; and

means for updating the position of the transducer in the electrophysical model.

26. The system of claim 25, wherein an electrophysical model of the transducer is generated by driving the transducer with a known set of signals, determining the position of the transducer, and measuring one or more of: the back EMF, the power supply voltage, and the transducer current.

27. The system of claim 25 further comprising means for applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.

28. A system for improving a sound generation device comprising the steps of:

means for measuring a power supply voltage of the device; and

means for adjusting a drive signal to the device to compensate for changes in the power supply voltage.

29. The system of claim 28 wherein the drive signal is adjusted by adjusting the shape of the drive signal.

30. The system of claim 29 wherein the pulse shape is adjusted by adjusting the amplitude and/or width of the pulse.

31. The system of claim 28 wherein the drive signal is adjusted by adjusting the amplitude of the drive signal.

32. The system of claim 28 which includes the means for generating a model of the power supply.

33. The system of claim 28 which includes:

means for modulating the output signal to minimize power supply induced distortion (PSID), wherein the output signal is provided to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.

34. A system for protecting a speaker having a transducer comprising:

means for continually determining a drive power provided to the transducer and

means for adjusting the drive signal based upon a safe power model of the transducer and the drive power.

35. The system of claim 34 wherein the drive power is integrated over time.

36 The system of claim 34 which includes the step of measuring a power supply

voltage to provide an output signal based upon the safe power model.

37. A computer readable medium containing program instructions for determining the positional BL factor of a transducer during sound transduction comprising the steps of:

(a) changing the current to the transducer;

(b) determining the current through the transducer;

(c) measuring the back EMF of the transducer; and

(d) calculating the positional BL factor from the change in EMF versus change in current.

38. The computer readable medium of claim 37, further comprising applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is one of a digital and analog.

39. A computer readable medium containing program instructionsfor measuring the back EMF of a transducer comprising the steps of:

(a) providing a digitally modulated signal; and

(b) measuring the voltage across the transducer during the off time of the digitally modulated signal.

40. The computer readable medium of claim 39, further comprising applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.

41. A computer readable medium containing program instructions for generating sound using a speaker having a transducer, comprising the steps of:

(a) determining the positional BL factor during sound transduction through continual measurements; and

(b) digitally modulating a drive signal based on a plurality of transducer models and the positional BL factor during sound transduction of the transducer.

42. The computer readable medium of claim 41, further comprising applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.

43. A computer readable medium containing program instructions for generating sound using a speaker having a transducer, comprising the steps of:

(a) generating an electrophysical model of the transducer,

(b) digitally modulating a drive signal based on the continually determined position of the transducer in the electrophysical model,

(c) determining a positional BL factor during sound transduction through continual measurements;

(d) calculating the position of the transducer based upon the BL factor;

(e) updating the position of the transducer in the electrophysical model; and

(f) repeating steps b-e.

44. The computer readable medium of claim 43, wherein an electrophysical model

of the transducer is generated by driving the transducer with a known set of signals, determining the position of the transducer, and measuring one or more of: the back EMF, the power supply voltage, and the transducer current.

45. The computer readable medium of claim 43 further comprising applying the drive signal to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.

46. A computer readable medium containing program instructions for improving a sound generation device comprising the steps of:

(a) measuring a power supply voltage of the device; and

(b) adjusting a drive signal to the device to compensate for changes in the power supply voltage.

47. The computer readable medium of claim 46 wherein the drive signal is adjusted by adjusting the shape of the drive signal.

48. The computer readable medium of claim 47 wherein the pulse shape is adjusted by adjusting the amplitude and/or width of the pulse.

49. The computer readable medium of claim 46 wherein the drive signal is adjusted by adjusting the amplitude of the drive signal.

50. The computer readable medium of claim 46 which includes the step of

generating a model of the power supply.

51. The computer readable medium of claim 46 which includes the step of:

(e) modulating the output signal to minimize power supply induced distortion (PSID), wherein the output signal is provided to a switch to drive the transducer to generate sound, wherein the drive signal is digital or analog.

52. A computer readable medium containing program instructions for protecting a speaker having a transducer comprising the steps of:

(a) continually determining a drive power provided to the transducer and

(b) adjusting the drive signal based upon a safe power model of the transducer and the drive power.

53. The computer readable medium of claim 52 wherein the drive power is integrated over time.

54. The computer readable medium of claim 52 which includes the step of measuring a power supply voltage to provide an output signal based upon the safe power model.